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Updates to the IPv6 Multicast Addressing Architecture
draft-boucadair-6man-multicast-addr-arch-update-00

Abstract

This document updates the IPv6 multicast addressing architecture by defining the 17-20 reserved bits as generic flag bits. The document provides also some clarifications related to the use of these flag bits.

This document updates RFC 3956, RFC 3306, RFC 4607 and RFC 4291.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

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1. Introduction

This document updates the IPv6 multicast addressing architecture [RFC4291] by defining the 17-20 reserved bits as generic flag bits (Section 2). The document provides also some clarifications related to the use of these flag bits (Section 3.1) and also about IANA assigned SSM blocks (Section 3.2).

This document updates [RFC3956], [RFC3306], [RFC4607] and [RFC4291].

2. Addressing Architecture Update

Bits 17-20 of a multicast address are defined in [RFC3956] and [RFC3306] as reserved bits. This document defines these bits as generic flag bits so that they apply to any multicast address. Figure 1 and Figure 2 show the updated structure of the addressing architecture. The first diagram shows the update of the base IPv6 addressing architecture, and the second shows the update of so-called Embedded-RP.

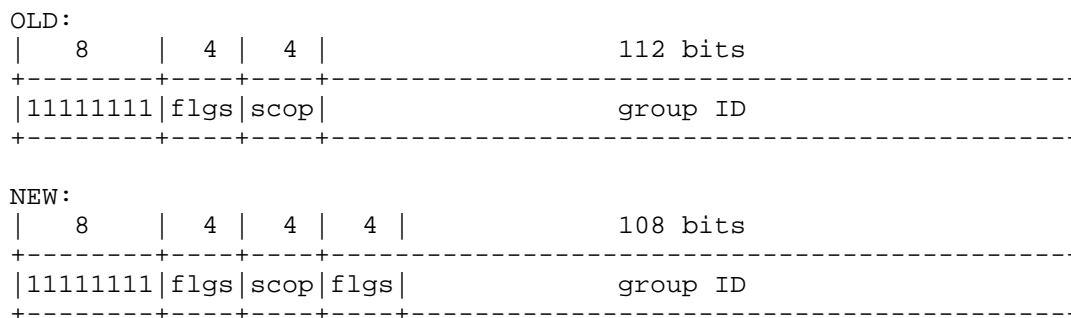


Figure 1: Updated IPv6 Multicast Addressing Architecture

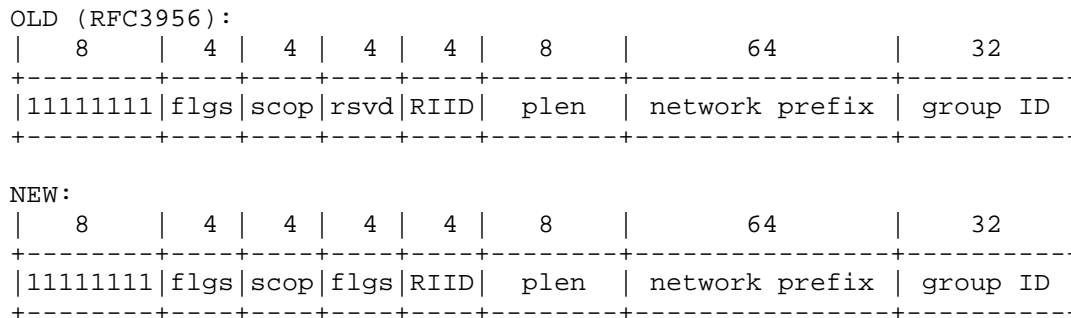


Figure 2: Embedded-RP with Updated IPv6 Multicast Address Arch.

Further specification documents may define a meaning for these flag bits. Defining the bits 17-20 as flags for all IPv6 multicast addresses allows addresses to be treated in a more uniform and generic way, and allows for these bits to be defined in the future for different purposes, irrespective of the specific type of multicast address.

3. Clarifications

3.1. Flag Bits

Some implementations and specification documents do not treat the flag bits as separate bits but tend to use their combined value as a 4-bit integer. This practice is a hurdle for assigning a meaning to the remaining flag bits. Below are listed some examples for illustration purposes:

- o the reading of [RFC4607] may lead to conclude that ff3x::/32 is the only allowed SSM IPv6 prefix block.
- o [RFC3956] states only ff70::/12 applies to Embedded-RP. Particularly, implementations should not treat the fff0::/12 range as Embedded-RP.

To avoid such confusion and to unambiguously associate a meaning with the remaining flags, the following recommendation is made

Implementations **MUST** treat flag bits as separate bits.

3.2. IANA Assigned SSM Block

Another issue related to SSM is the IANA assigned SSM address block. Per [RFC4607], ff3x::4000:0001 through ff3x::7fff:fff is the block for IANA assignments (<http://www.iana.org/assignments/ipv6-multicast-addresses/ipv6-multicast-addresses.xml>). However, IANA assignments are permanent addresses and should not have the transient bit set. Quoting from [RFC4607]:

"T = 1 indicates a non-permanently-assigned ("transient") multicast address."

4. IANA Considerations

This document may require IANA updates. However, at this point it is not clear exactly what these updates may be.

5. Security Considerations

Security considerations discussed in [RFC3956], [RFC3306], [RFC4607] and [RFC4291] MUST be taken into account.

6. Acknowledgements

Many thanks to B. Haberman for the discussions prior to the publication of this document.

7. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [RFC3306] Haberman, B. and D. Thaler, "Unicast-Prefix-based IPv6 Multicast Addresses", RFC 3306, August 2002.
- [RFC3956] Savola, P. and B. Haberman, "Embedding the Rendezvous Point (RP) Address in an IPv6 Multicast Address", RFC 3956, November 2004.
- [RFC4291] Hinden, R. and S. Deering, "IP Version 6 Addressing Architecture", RFC 4291, February 2006.
- [RFC4607] Holbrook, H. and B. Cain, "Source-Specific Multicast for IP", RFC 4607, August 2006.

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Interconnecting IPv6 Multicast Islands over IPv4 Using IPv6 Multicast
Provider Edge Routers
draft-wang-mboned-glo-ipv6-mcast-reachability-01

Abstract

This draft presents a method to interconnect IPv6 multicast islands over an IPv4 cloud. This method relies on IPv6 Multicast Provider Edge routers (6MPE), which support Dual-Stack and in order to connect IPv6 multicast islands to the IPv4 core. The 6MPE routers extend the Multiprotocol Border Gateway Protocol (MP-BGP), define a new Network Layer Reachability Information (NLRI) called MCAST-IPv6 NLRI, and exchange the IPv6 multicast reachability information transparently over the IPv4 core using the MP-BGP.

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1. Introduction

There is already an approach for providing IPv6 connectivity over an IPv4 core network named Software Mesh Multicast, however, this approach results in inefficient bandwidth and resource utilization. And there is also already an approach for providing IPv4/IPv6 connectivity over VPN core network name MVPN[RFC6513] and MVPN-BGP[RFC6514], however, this approach just provides VPN service over IPv4/IPv6 network. The approach used in this document named IPv6 Multicast Provider Edge (6MPE) is a MVPN-like solution which connects non-VPN IPv6 multicast islands over IPv4 core network.

The 6MPE approach specified in this document requires that the edge routers (the 6MPE routers) be connected to IPv6 multicast islands and support Dual-Stack Multiprotocol-BGP, and the core routers run IPv4 only. And can be used for customers that already have an IPv4 multicast service from the network provider and additionally require an IPv6 multicast service, as well as for customers that require only IPv6 connectivity.

The 6MPE approach specified in this document defines a new Network Layer Reachability Information (NLRI)[RFC4760], MCAST-IPv6 NLRI. The MCAST-IPv6 NLRI is used for 6MPE routers auto-discovery, advertising IPv6 islands multicast routing information exchange among 6MPE routers.

Note that the 6MPE approach specified in this document provides global IPv6 reachability. Deployment of the 6MPE approach over an existing IPv4 cloud does not require an introduction of new mechanisms in the core. Configurations and operations of the 6MPE approach have a lot of similarities with the configurations and operations of an IPv4 MVPN service or IPv6 MVPN service ([RFC6513] and [RFC6514]). However, the configuration and operations of the 6MPE approach are somewhat simpler, since it does not involve all the VPN concepts such as Virtual Routing and Forwarding (VRFs) tables, RD and aggregation etc.

This document cites the format of Route Type defined in MCAST-VPN NLRI and modifies the format to adapt MCAST-IPv6 NLRI, which discussed in following sections in details.

This document cites the PMSI Tunnel Attribute defined in MVPN-BGP (RFC6514) and modifies the format to adapt tunnel attribute defined in 6MPE approach, which discussed in following section in details.

This document cites a BGP Extended Communities defined in MVPN: the source Autonomous System (AS) Extended Community.

In this document an "IPv6 multicast island" is a network running native IPv6 multicast. A typical example of an IPv6 multicast island would be a customer's IPv6 site connected via its IPv6 Customer Edge (CE) to one (or more) Dual-Stack Multicast Provider Edge router(s) of a Service Provider. These IPv6 Multicast Provider Edge routers (6MPE) are connected to an IPv4 core network. Corresponding scenario sees figure 1.

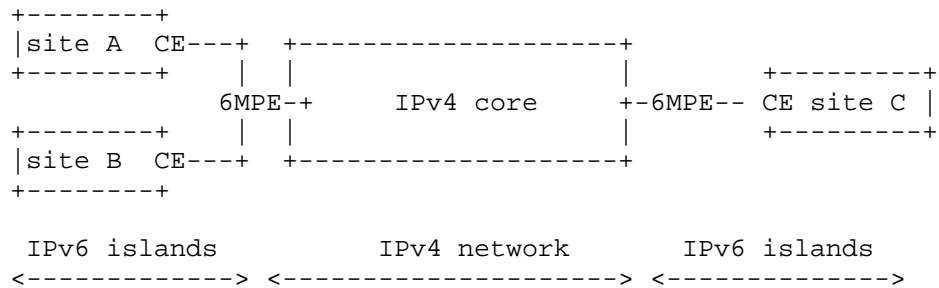


Figure 1: A Framework for IPv6 Multicast Interconnect over IPv4 Network

2. Keywords and Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2.1. Terminology, and Definition of Terms

In the context of this document, we will refer to the 6MPE auto-discovery/binding information carried in BGP as "6MPE A-D routes". And there are the following types of 6MPE A-D routes:

- + Intra-AS 6MPE A-D route;
- + Inter-AS 6MPE A-D route;
- + 4-MSI 6MPE A-D route;
- + Leaf 6MPE A-D route;
- + Source Active 6MPE A-D route;

In the context of this document, we will refer to the 6MPE customers multicast routing information carried in BGP as "IPv6-multicast routes". And there are the following types of IPv6-multicast routes:

- + (*,G) Join route;
- + (S,G) Join route;

3. MCAST-IPv6 NLRI

This document defines a new BGP NLRI, called the MCAST-IPv6 NLRI. The format of the MCAST-IPv6 NLRI is the same as MCAST-VPN NLRI and the Route Types for 6MPE A-D routes are as follow:

- +1 Intra-AS 6MPE A-D route;
- +2 Inter-AS 6MPE A-D route;
- +3 4-MSI 6MPE A-D route;
- +4 Leaf 6MPE A-D route;
- +5 Source Active 6MPE A-D route;
- +6 (*,G) Join route;
- +7 (S,G) Join route;

The MCAST-IPv6 NLRI is carried in BGP using BGP Multiprotocol Extensions with Address Family Identifier(AFI) of 2 and a Subsequent AFI(SAFI) of MCAST-IPv6.

In order for two BGP speakers to exchange MCAST-IPv6 NLRIs, they must use a BGP Capabilities Advertisement to ensure that they both are capable of properly processing such an NLRI. This is done as specified in [RFC4760], by using capability code 1 with an AFI of 2 and an SAFI of MCAST-IPv6.

The format of the Route Type specific MCAST-IPv6 NLRI for various Route Types defined in this document cite from MVPN, except remove the RD field in each Route Type and replace the Originating Router's IP Addr with 6MPE Router-ID.

6MPE Router-ID uniquely identifies a 6MPE router.

4. Tunnel Attribute

This document can define and use a new BGP attribute called the "IPv4-Multicast Service Interface Tunnel (4-MSI) attribute" which is like PMSI Tunnel Attribute defined in MVPN but remove the MPLS Label field or reuse PMSI Tunnel Attribute but set the MPLS Label field invalid value.

The Tunnel Type and the usage are the same as the Tunnel Type in PMSI Tunnel attribute.

5. Protocol Overview

Interconnection of IPv6 multicast islands over an IPv4 network is achieved by executing the following steps:

1. The 6MPE routers MUST have auto-discovery/binding mechanism[RFC6513 and RFC6514] to discovery other 6MPE routers, and trigger IPv4 cloud to build inclusive IPv4-multicast service tunnel as necessary.
2. Exchange IPv6 multicast routing reachability information among 6MPE routers.
3. Trigger IPv4 cloud to build selective IPv4-multicast service tunnel.

In executing step 1-3, the 6MPE routers convey the IPv4 address of 6MPE Router-ID as the BGP Next Hop for the advertised A-D routes. And the IPv4 address MUST be encoded as an IPv4-mapped IPv6 address in the BGP Next Hop field. This encoding is consistent with the definition of an IPv4-mapped IPv6 address in [RFC4291].

4. Binding IPv6 multicast islands' multicast tree to selective IPv4-multicast service tunnel.
5. Transport IPv6 multicast packets from the ingress 6MPE router which is nearby the IPv6 multicast source to the egress 6MPE routers which are nearby the multicast receivers over IPv4-multicast service tunnel.

6. Security Considerations

The security considerations documented in [RFC6513] and [RFC6514] are to be considered. Additional requirements may be added in the future version of this draft.

7. IANA Considerations

This document defines a new NLRI, called "MCAST-IPv6", to be carried in BGP.

8. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [RFC4271] Rekhter, Y., Li, T., and S. Hares, "A Border Gateway Protocol 4 (BGP-4)", RFC 4271, January 2006.
- [RFC4291] Hinden, R. and S. Deering, "IP Version 6 Addressing Architecture", RFC 4291, February 2006.
- [RFC4760] Bates, T., Chandra, R., Katz, D., and Y. Rekhter, "Multiprotocol Extensions for BGP-4", RFC 4760, January 2007.
- [RFC6513] Rosen, E. and R. Aggarwal, "Multicast in MPLS/BGP IP VPNs", RFC 6513, February 2012.
- [RFC6514] Aggarwal, R., Rosen, E., Morin, T., and Y. Rekhter, "BGP Encodings and Procedures for Multicast in MPLS/BGP IP VPNs", RFC 6514, February 2012.

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Multicast transition path optimization in IPv4 and IPv6 networks
draft-zhou-mboned-multtrans-path-optimization-03

Abstract

This document describes a mechanism to optimize the path between the multicast router and multicast source in both IPv4 and IPv6 networks. The basic idea is that when a multicast translation router has an IPv4 path and an IPv6 path to the same multicast data source, and both IPv4 and IPv6 joins are received, only one path is used. One path is pruned, instead of the same traffic flowing over both v4 and v6 paths. By adding a metric to the IPv4 path, the multicast translation router can determine which path to receive multicast data: IPv4 path, IPv6 path or both. Therefore, an optimization path will typically be chosen when an identical v4/v6 traffic flow exists.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in .

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1. Introduction

It is common to use multi-access LANs such as Ethernet for transmitting multicast data in networks. Section 3.6 of[RFC4601] describes Multi-Access Transit LANs.

The PIM Assert message could be used when there are two identical multicast data flows (IPv4 and IPv6). When duplicate data packets appear on the LAN from different routers, the routers notice this and then select a single forwarder. This selection is performed using PIM Assert messages, which solve the problem in favor of the upstream router that has (S,G) state; Or, if neither or both router has (S,G) state, then the problem is solved in favor of the router with the best metric to the RP for RP trees, or the best metric to the source via source-specific trees.

During IPv6 transition, it is common that there are many IPv4 networks and IPv6 networks that connected to each other, which means that multiple multicast translation routers(MTR) exist at the edge of a network. For robustness, reliability and load balance purpose, MTR function could be implemented in several nodes in the network. MTR can be the mAFTR (Multicast AFTR) mentioned in [draft-ietf-softwire-dslite-multicast]. mAFTR can encapsulate IPv4 multicast data in IPv6 tunnel. MTR can also be the mXlate (Multicast Translator) as mentioned in [draft-lee-behave-v4v6-mcast-fwk]. mXlate can translate IPv4 multicast data to IPv6 multicast data.

As a result, MTR (mXlate or mAFTR) will have more than one path to reach the RP or source S in IPv4 networks and IPv6 networks. Or in other words, they will have two upstream routers: one is IPv6 router, and the other is IPv4 router. MTR can reach the RP or source S by both paths. Since MTR can receive both IPv4 and IPv6 (*,G) (or (S,G)) Join request, it needs to select a best path to RP or S in both IPv4 and IPv6 networks. When it receives the two identical multicast data flows via IPv4 and IPv6 interfaces, MTR needs to send Prune Message to the worse path interface. Figure 1 shows the scenario that MTR can reach source S through both IPv4 path and IPv6 path.

2. Terminology

This document makes use of the following terms:

mXlate: A multicast translator mentioned in [draft-lee-behave-v4v6-mcast-fwk].

mAFTR: A multicast Address Family Transition Router mentioned in [draft-ietf-softwire-dslite-multicast].

MTR: A multicast translation router, it can be mAFTR or mXlate.

PIM-SM: Protocol Independent Multicast-Sparse Mode

RP: Rendezvous Point

3. Scenarios

During the multicast transition from IPv4 to IPv6, there may be a router which receives IPv4 join (PIM or IGMP) on one interface, and an IPv6 join (PIM or MLD) on another interface (or it could even be the same interface). The router should support IPv4 PIM and IPv6 PIM that is translation capable. Assume these joins are for both IPv4 (S4,G4) and IPv6 (S6,G6), and that there are active sources for both, sending basically the same content. Either because there is a real source for both, or some upstream router is translating. The router could then simply send upstream joins for both of these, and forward the traffic as needed without translation.

However, if the router is aware that the same content comes from these two sources, it could select to join one of the streams, and translate as needed for the one downstream that wants a different protocol. In this case, there will be a tradeoff between bandwidth on the upstream links, and the cost of translation (both on this device, and perhaps the quality of the stream). When PIM Assert message is used to achieve this, the metrics for IPv4 and IPv6 should be comparable and all the PIM devices on the link should support PIM assert.

4. Solution Overview

This section gives a solution for the issues mentioned above.

4.1. A general topology for IPv4 and IPv6 multicast networks

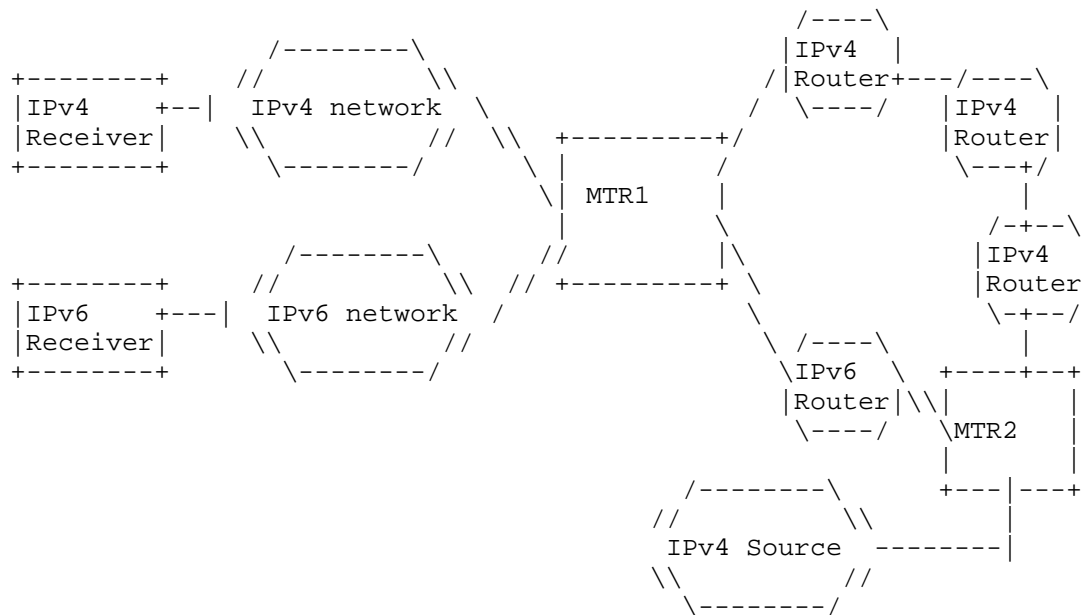
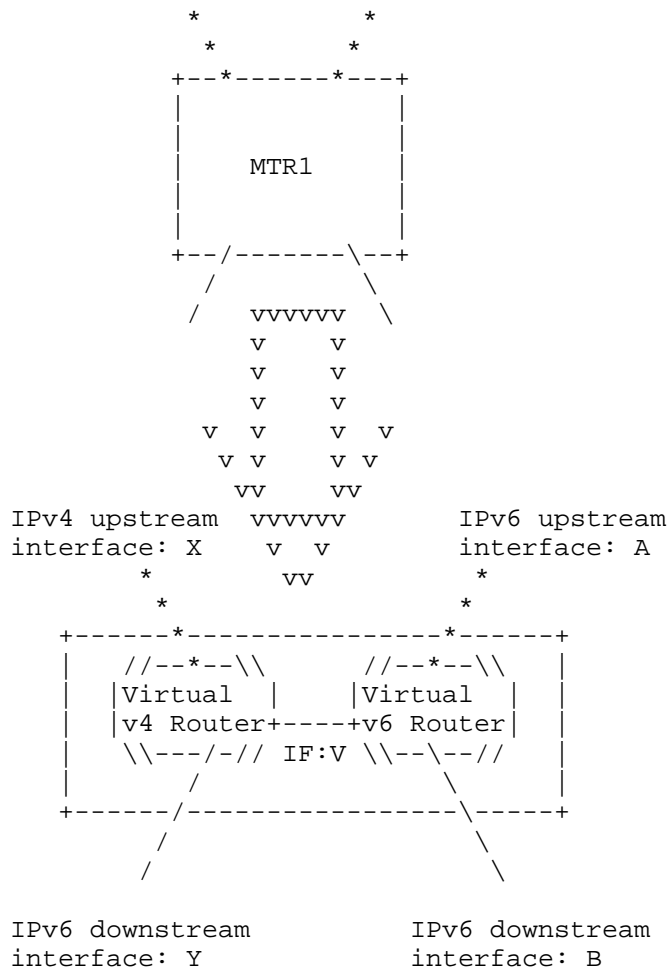


Figure 1: MTR1 can reach IPv4 Source through IPv4 path and IPv6 path

Figure 1 shows that MTR1 can access IPv4 Source through IPv4 path or IPv6 path. MTR1 has two upstream routers, one is IPv4 Router and the other is IPv6 Router. MTR1 receives IPv4 (*,G) or (S,G) Join request from IPv4 network and IPv6 (*,G) or (S,G) Join request from IPv6 network. MTR1 can send Join request to RP or source S from interface connected to IPv4 Router or from interface connected to IPv6 Router. MTR1 may also send Join request from both upstream interfaces. In this case, MTR1 need to select a best path to RP or S in both IPv4 and IPv6 networks. MTR1 sends Prune Message to the worse path, when it receives two identical multicast data flows in IPv4 and IPv6 upstream interface. MTR1 may receive two identical multicast data flows at the same time and stop interworking multicast data flow between IPv4 network and IPv6 network.

4.2. Parsing MTR to two virtual Routers



For simplification, we use two virtual Routers to replace MTR1 Router. Figure 2 shows that MTR1 can be taken as two virtual Routers. The one on the left is a Virtual IPv4 Router, the one on the right is a Virtual IPv6 Router. Virtual IPv4 Router has an IPv4 upstream interface X and an IPv4 downstream interface Y. Virtual IPv6 Router has an IPv6 upstream interface A and an IPv6 downstream interface B. The interface between two virtual Routers is V.

When MTR receives two multicast data flows (one from IPv4 interface and the other from IPv6 interface), it compares two flows according to [draft-ietf-mboned-64-multicast-address-format] to confirm whether they are identical data flows. If they are the same, select one or

two. When MTR Receives a IPv6 (S, G) or (*, G)Join, virtual IPv6 Router selects an interface to send Join message. The interface can be IPv6 upstream interface A or IPv4 upstream interface X (via interface V).

4.3. Selecting interfaces to Source or RP

The procedure to select an interface to S or RP is as below.

- 1.Set the Metric value $m1$ for translation or encapsulation from IPv4 muticast to IPv6 multicast data.
- 2.From interface A connecting IPv6 Router, MTR can get the metric $m2$ to reach S or RP by PIM assert message sent from IPv6 Router.
- 3.From interface X connecting IPv4 Router, MTR can get the metric $m3$ to reach S or RP by PIM assert message from IPv4 Router.
- 4.When MTR receives a IPv6 PIM Join message, virtual IPv6 Router compares $m2$ and $m3+m1$. If $m2 > m3+m1$, sending PIM Join message from IPv4 interface; If $m2 < m3+m1$, sending PIM Join message from IPv6 interface; If $m2 = m3+m1$, MTR can choose interface X or A to send PIM Join message.

4.4. Selecting a multicast data flow from upstream interface

The procedure to select a multicast data flow from upstream interface is as below:

- 1.MTR receives two identical mulitcast flows from IPv6 and IPv4 Router. The address formats of the two flows follows [draft-ietf-mboned-64-multicast-address-format].
- 2.If virtual IPv6 Router receives multicast data from interface V, it will compare $m2$ and $m3+m1$ (the value is from last section).
- 3.If $m2 > m3+m1$, MTR will send PIM Prune Messages to IPv6 interface A; If $m2 < m3+m1$ MTR will send PIM Prune Messages to interfaceX via virtual interface V. MTR will not translate multicast data from IPv4 to IPv6 or encapsulate IPv4 multicast data in IPv6 packets. If $m2 = m3+m1$, MTR selects any interface to receive multicast data and sends PIM Prune Messages to the other interface.

4.5. Requirements to the mulitcast Router

The requirement to the edge PIM-SM Router includes:

Edge PIM-SM Router needs to check multicast data flow from IPv4 and IPv6 interfaces based on [draft-ietf-mboned-64-multicast-address-format] to determine whether they are the same multicast data flow.

Edge PIM-SM Router sends PIM Assert messages via IPv4 and IPv6 interfaces with different Metric value.

Edge PIM-SM Router may stop translating/encapsulating IPv4 multicast flow to IPv6 multicast flow or send Prune Messages to stop receiving IPv6/IPv4 multicast flow.

5. Security Considerations

6. Acknowledgments

Thanks Ronald Bonica, Stig Venaas and Yiu Lee for their valuable comments.

7. IANA Considerations

8. Informative References

- [RFC4601] IETF, "Protocol Independent Multicast-Sparse Mode (PIM-SM): Protocol Specification (Revised)", Aug 2006, <<http://datatracker.ietf.org/doc/rfc4601/>>.
- [draft-ietf-mboned-64-multicast-address-format] IETF, "IPv6 Multicast Address With Embedded IPv4 Multicast Address", August 2012, <<http://datatracker.ietf.org/doc/draft-ietf-mboned-64-multicast-address-format/>>.
- [draft-ietf-softwire-dslite-multicast] IETF, "Delivery of IPv4 Multicast Services to IPv4 Clients over an IPv6 Multicast Network", Oct 2012, <<http://datatracker.ietf.org/doc/draft-ietf-softwire-dslite-multicast/>>.
- [draft-lee-behave-v4v6-mcast-fwk] IETF, "IPv4/IPv6 Multicast Translation Framework", Feb 2011, <<http://tools.ietf.org/id/draft-lee-behave-v4v6-mcast-fwk-00.txt>>.

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